Space Weather Technical Forecast

Issued on Monday, 08 November 2021 at 13:04 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active Electron Fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar Activity rose to Low over the past 24 hours, with increased X-ray flux recorded at GOES 17 late in the period largely the result of rapid development of a new sunspot region in the sun's northeastern quadrant. This group was numbered AR2895 in the period, and produced peak activity of a C1.3 at 08/0751UTC as it reached Dai/Beta complexity. This is one of three numbered groups on the disc, the others being AR2893, a stable Alpha Hsx; and 2894, a Cro/beta with slight areal decay evident. AR1891, the sunspot group responsible for recent significant X-ray flares and geomagnetic activity became indistinct in the far northwest and will shortly leave the Earth-facing disc. No Earth-directed Coronal Mass Ejections (CMEs) have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, saw a continued decline in the period, falling from near 490km/s to reach 400km/s by the period's end. The solar wind density exhibited a roughly level trend near the long-term background within mid-single figures ppcc, while the IMF was stable and unremarkable, with a 5nT peak and a north-south component between -2 and +4nT, i.e. with a mostly co-aligned bias. The phi angle was orientated towards the sun throughout. The net result of the above solar wind measures was provisionally Quiet Kp indices throughout, peaking at just 1- in the 15-18UTC interval.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at Background levels. The high energy electron flux (greater than 2 MeV) showed a stable oscillation about the High flux threshold, peaking at 3529pfu at 07/1905UTC, and resulting in 24-hour integrated fluence almost exactly tracing the Active threshold, with a very slight decline evident and a 08/0000UTC value of 1.02e8 integrated pfu recorded.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is Likely to be Low in the period, with a now increased daily Slight Chance of M-class flares - largely the result of growth of AR2895 in the northeastern quadrant.

Solar Wind / Geomagnetic Activity: There are no definitively Earth-directed CMEs in the forecast period, although two CMEs passing ahead of the Earth late on day three, Wednesday 10 into Thursday 11 November, have a Slight Chance of bringing some glancing effects.

Otherwise, the current declining trend to ambient conditions in solar wind may reverse slightly on day one (Monday 08 November), the result of any fast wind from coronal hole 17, although this is expected to be muted, with a resumption of the declining trend then expected by midweek at the latest.

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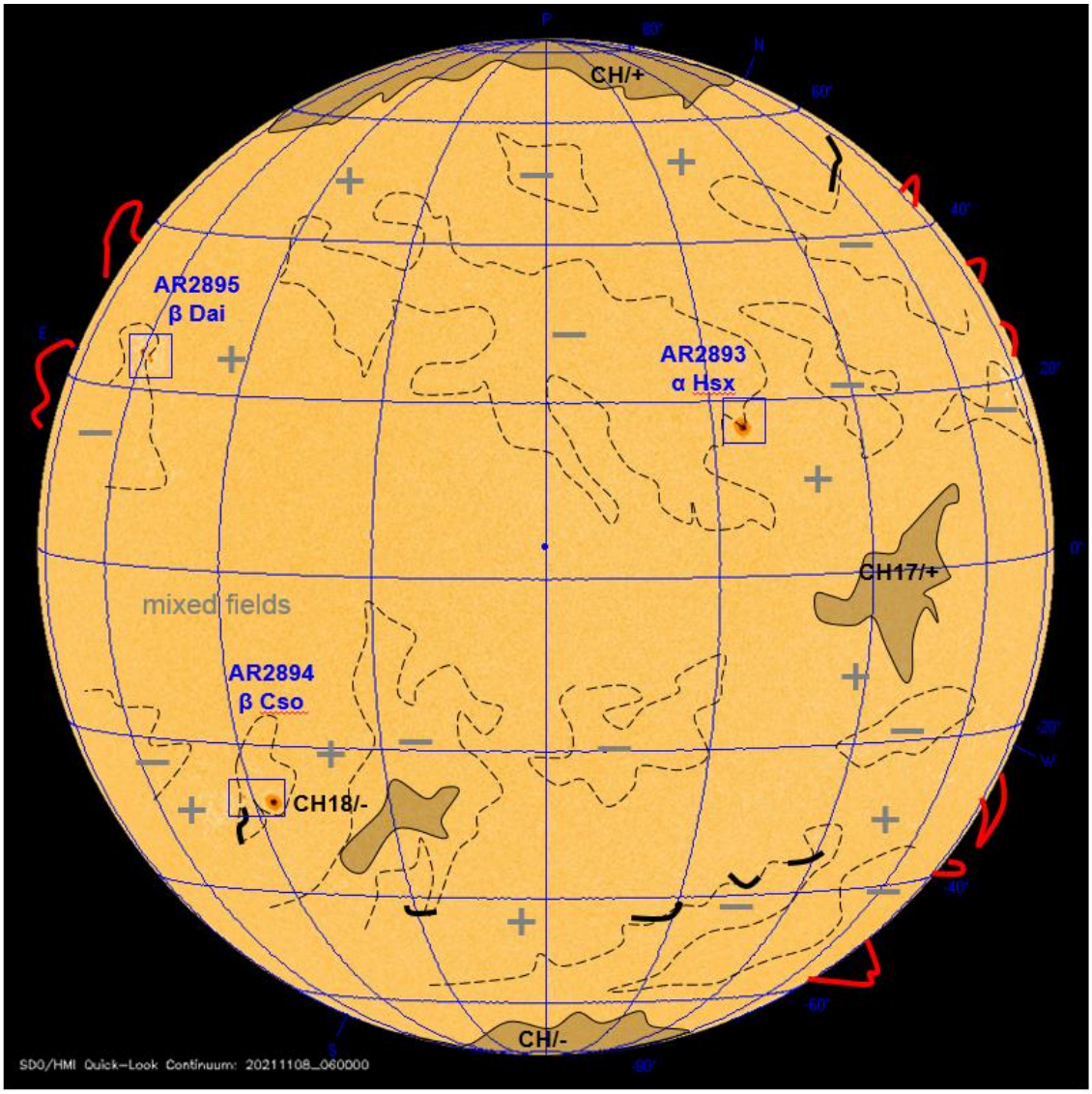
Geomagnetic activity is forecast to be mostly Quiet, with the greatest chance of Active intervals to start and end the four days, the result of CH17 and any glancing incidence of the CMEs respectively.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at Background levels.

The high energy electron flux (greater than 2 MeV) will most likely see peak values very gradually decay through the period, with any arrival of fast wind from CH17 also likely to help flux levels reset at a lower diurnal trend. Active 24-hour electron fluence starting the four days will most likely fall below the Active (1e8 integrated pfu) level through day 1 (Monday 08 November), with the probability of continuation of Active falling day-on-day.

Figure 1. Solar Analysis Valid 08/0600UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No definitively Earth-directed CMEs feature in the current forecast, however up to two weak CMEs are expected to pass narrowly ahead of Earth late day 3 and into day 4 (Wednesday 10 into Thursday 11). Peripheral influences are possible around this time - as hinted at by a minority of MOSWOC Enlil ensemble members.

Solar winds are currently continuing a slow decline towards ambient levels. A further slight enhancement or hiatus in the declining trend is possible over the remainder of day 1 (Monday 08 November) as Earth encounters any fast wind from coronal hole 17. This is a small equatorial feature, apparently of diminishing size with westward progress, although this may be in part due to the narrowing viewing angle. With no enhancement visible at STEREO A in recent days, any enhancement is likely to be small if present, and of generally low confidence for lack of a good analogue on the last rotation (polluted by a CME and with a differing coronal hole layout). Otherwise, solar winds are expected to gradually ease towards background in the four days.

Geomagnetic activity is forecast to be mostly Quiet, with Active intervals most likely to start and end the four days: the result of any influence from CH17 and up to two close passes from CMEs respectively.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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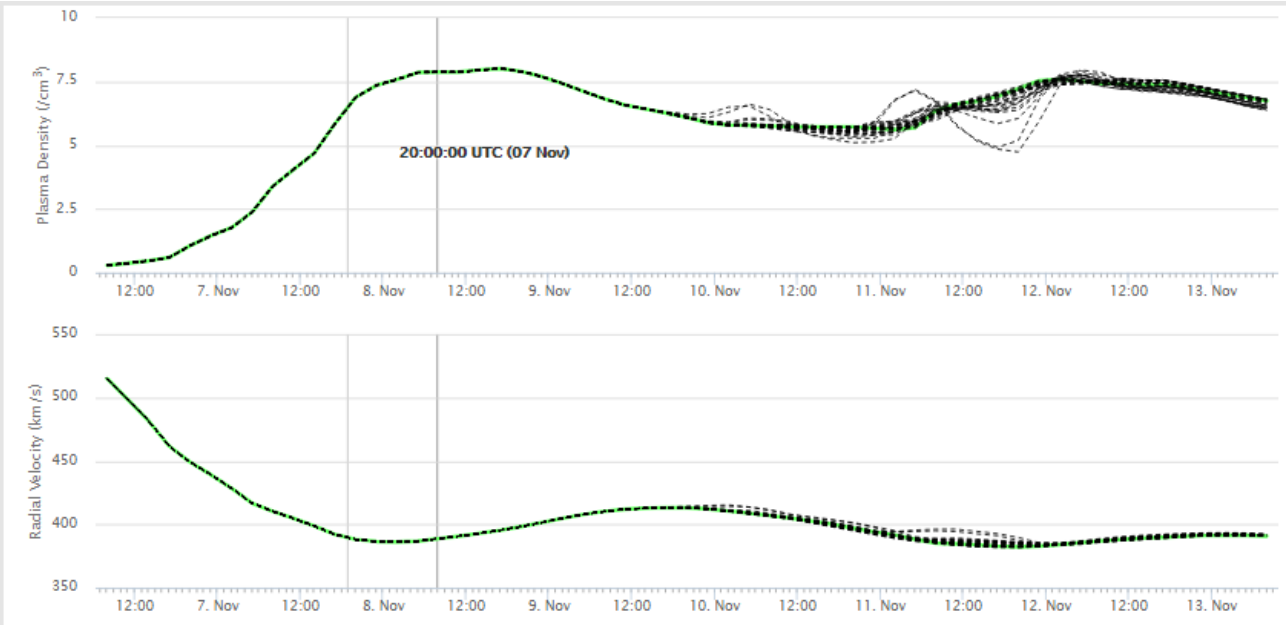
Figure 2: Latest MOSWOC Enlil output, showing roughly three of the 24-member ensemble as being marginally disturbed by one or two passing CMEs later in the four-day forecast period. The most likely forecast is therefore a continuation of Quiet geomagnetic conditions throughout.



Radio Blackouts - X-Ray Flares:

Solar activity is Likely to be Low in the period, with a now increased daily Slight Chance of M-class flares. This is due to the rapid emergence and now congested appearance of AR2895 in the northeastern quadrant, with occasional C-class activity emanating from this spot group by the period's end.

In terms of the balance of probabilities, no significant regions are due to leave or return in the period, with a stable trend therefore expected, but note that this is independent of any development of AR2895 in particular.

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 M Class**	No	10	10	10	10
Very Active	**R3 to R5 X Class**	No	1	1	1	1

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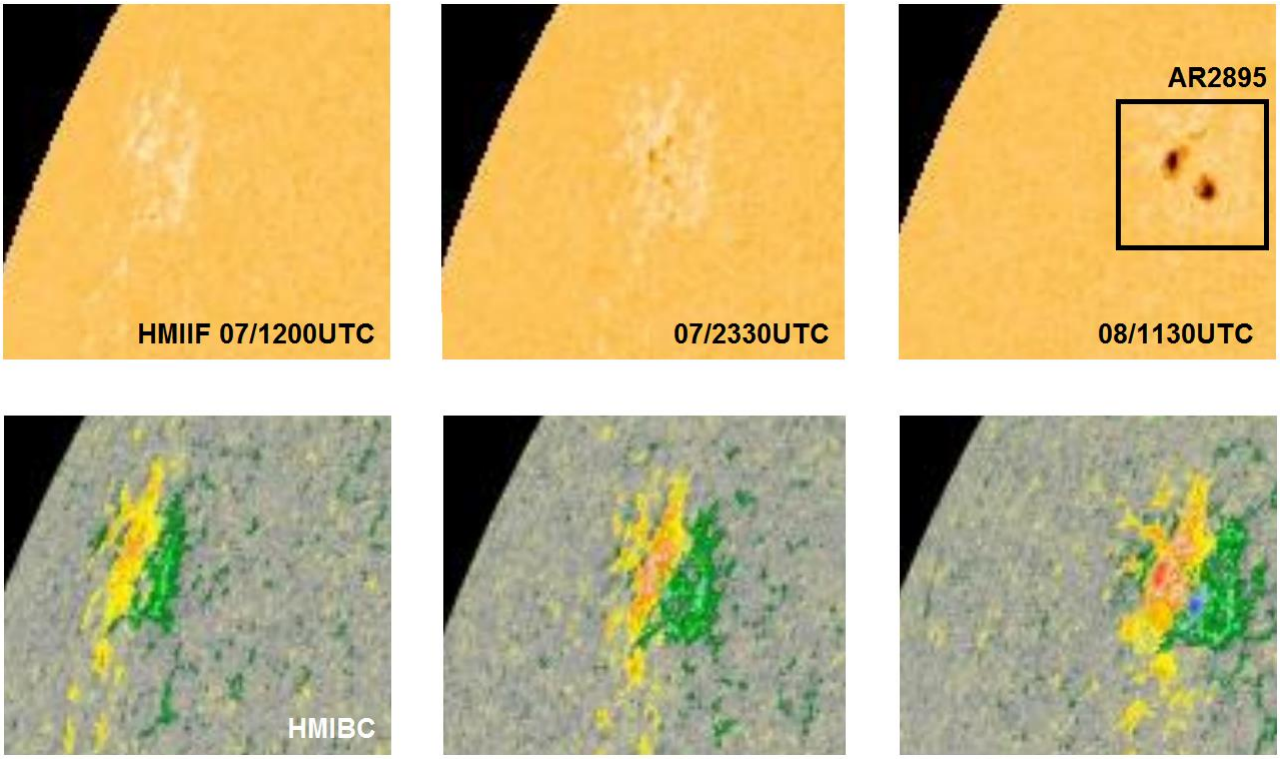
Figure 3: Development of the newly-developed AR2895 through the 24-hour period, reaching Dai/Beta by the period's end.



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is at background levels, and is forecast to remain at these levels through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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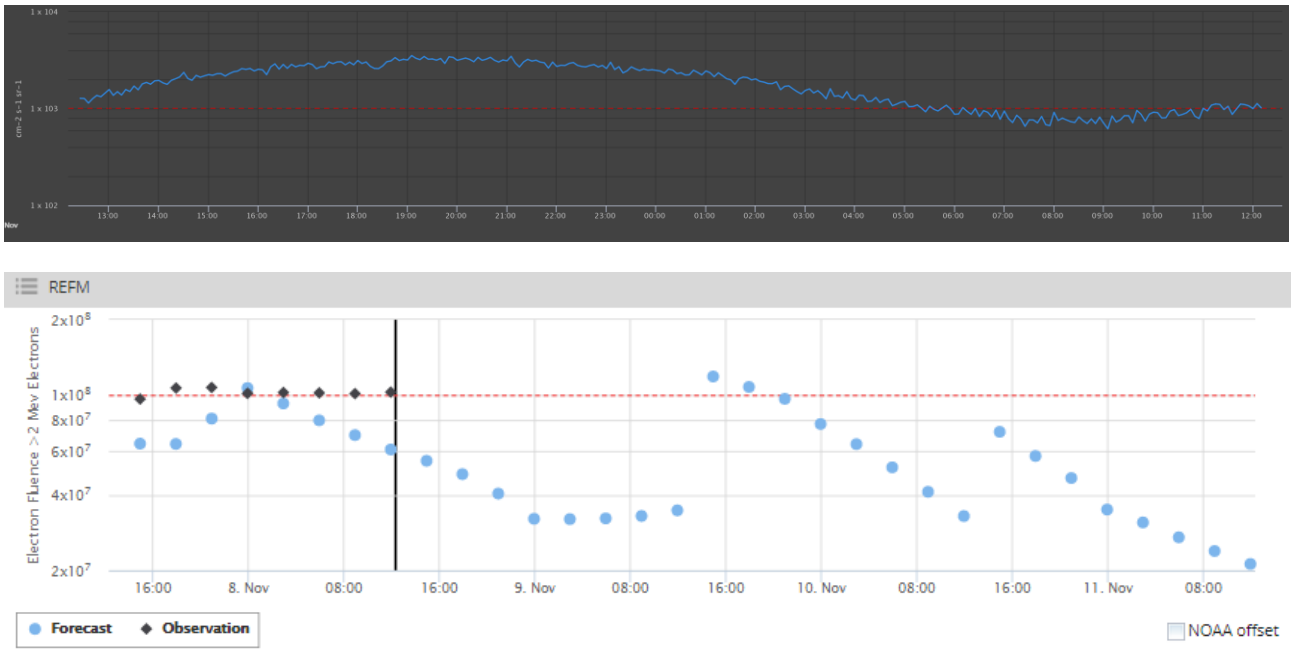
High Energy Electrons Event (≥ 2MeV):

The observed high energy (greater than 2 MeV) electron flux at GEO by GOES-16 is at Moderate to High levels, after the CME arrivals during the previous few days, leading to a period of elevated to strong solar winds. There is the potential for a drop out of values on day 1 (8th), from any geomagnetic activity from the arrival of the weak fast wind from CH17. However this is low confidence. Otherwise, the current high levels are expected to gradually decay, with peak values increasingly likely to be at Moderate levels from day 2 onward (9th)

The associated 24-hour electron fluence is currently Active, but is expected to decline through the period, likely below the Active level by day 2 (9th) onward. This only moderate confidence however, with REFM suggesting fluence levels will be varying around the Active threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	40	30	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Current GOES 17 electron flux and fluence obersevations, showing a diurnal osciallтion about High flux that is resulting in narrow exceedence of the 24-hour integrated Active threshold. This osciallтion is expected to gradually ebb in the less supportive solar wind environment in the coming four days, albeit with low confidence.



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